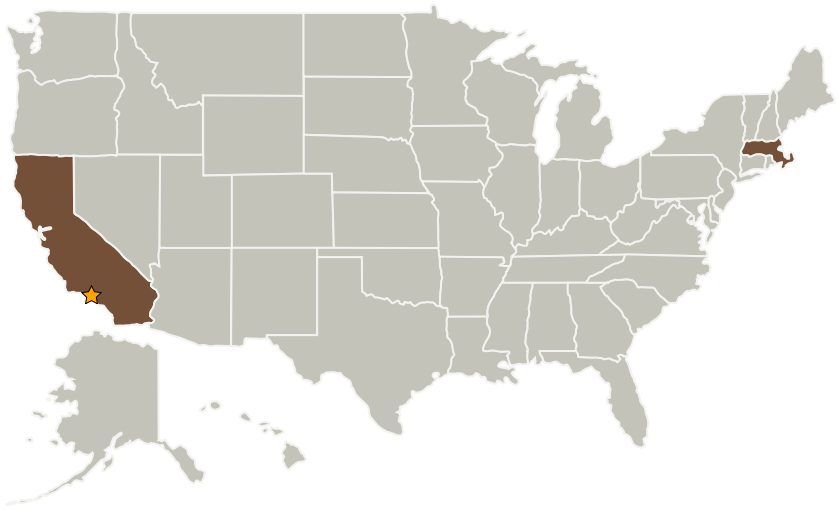
Quantum Cascade Laser-Based Local Oscillator for Terahertz Astronomy (7275-070), Phase I

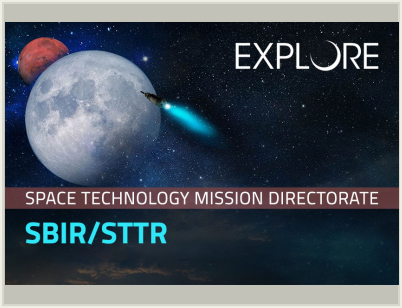
Completed Technology Project (2005 - 2005)

Project Introduction

Scientists at JPL measure radiation emitted in the far-infrared (or terahertz) region of the spectrum to study the history of the universe and the Earth's atmosphere. The most commonly used detection technique is frequency mixing between that emission and a local oscillator operating at a frequency close to the emission line. The local oscillators available today, such as optically pumped terahertz lasers or frequency-multiplied millimeter-wave sources, suffer from a number of shortcomings including limited tuning range, inadequate wavelength coverage, large size, and low wallplug efficiency. Physical Sciences Inc. has recently demonstrated a novel, tunable THz laser source based on an external cavity stabilized THz Quantum Cascade Laser with discontinuous tuning over a 30 GHz band at 147 wavenumbers. In the proposed Phase I program, we will use an available 158 wavenumber THz QCL to optimize the external cavity design for continuous, mode-hop free tuning over an expected range of 100 GHz with a target laser linewidth below 1 MHz. Such a laser has never been previously demonstrated. During Phase II we will prove practicality by optimizing the properties of the laser, packaging it into a form suitable for terahertz emission experiments, and delivering it to JPL.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
Physical Sciences, Inc.	Supporting Organization	Industry	Andover, Massachusetts

Primary U.S. Work Locations	
California	Massachusetts

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Joel Hensley

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.5 Lasers